Remarks

Claims 1-9 are pending in the application. Claims 1-6 are rejected. Claims 7-9 are objected to. All rejections are respectfully traversed.

Further, the arguments in response to office actions dated July 16, 2004, and May 6, 2005, are incorporated herein.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Walker (U.S. Patent No. 6,222,881) in view of Ribas-Corbera et al. (U.S. Patent No. 6,396,956).

The invention encodes a video as video objects. For each candidate object, a quantizer parameter and a skip parameter that jointly minimize an average total distortion in the video are determined while satisfying predetermined constraints. The average total distortion includes spatial distortion of coded objects and spatial and temporal distortion of uncoded objects. Then, the candidate object is encoded as the coded object with the quantizer parameter and the skip parameter, and the candidate object is skipped as the uncoded objects with the skip parameter.

As stated in previous amendments, Walker discloses a complexity measure. Nowhere does Walker disclose determining any type of distortion. Furthermore, the claimed average total distortion includes spatial distortion of coded objects and spatial and temporal distortion of uncoded objects. Obviously, Walker cannot disclose any of these limitations either.

The Examiner states that "Walker fails to disclose [that] the average total distortion is based on a quantizer and [a] skip parameter." In truth, Walker does not disclose anything about any type of distortion.

The Examiner states that Walker determines "whether image data is acceptable or not," referencing Figure 6 and conditions 610 and 614.

Walker determines if the sum of the absolute values of the quantized DCT coefficient differences is less than a specified dead-band threshold (step 610 of FIG. 6), and then encodes the block as a skipped block. Walker also determines if the number of inter block coefficients is less than the number of intra block coefficients (step 614), and then encodes the block as an inter block.

First, there is nothing in Walker that indicates that the steps in Figure 6 have to do anything with acceptability of an image. The steps in Figure 6 deal with how to encode macroblocks. Second, the encoding of macroblocks has nothing to do with the claimed distortion. Applicants respectfully request that the examiner explain the meaning of this statement in terms of the rejection of the claims.

The Examiner states:

> Ribas teaches that block and frame skipping and quantization parameters reduce the distortion of an image (Ribas: column 2, lines 57-65, column 3, line 62 – column 4, line 3, column 6, line 66 – column 7, line 6).

At column 2, lines 57-65, Ribas states:

> Frame skipping predicts the distortion quality of an entire frame before encoding. If the predicted frame quality is below a distortion threshold, more bits are assigned to that frame while other frames are skipped.
>
> Block skipping and frame skipping provide more efficient bit rate control by not allocating bits to blocks or frames that should not be encoded. Block and frame skipping reduce up to 90 percent of the computational complexity of the DCT/quantization procedure at the encoder.

At column 3, line 62 - column 4, line 3, Ribas states:

> The affect of the quantization steps Q_i on the distortion in the coded image is modeled below. High distortion indicates low image quality and vice versa. For the distortion in the i-th image block 14, D_i is the mean squared error (MSE) between the pixel values in the i-th original block 14 and those in the previously encoded version of the block output as encoded bit stream 24 from coder 20. The distortion DO increases with coarser quantization, i.e., larger Q_i. The following approximate expression is derived for D_i:

and, at column 6, line 66 - column 7, line 6, Ribas states:

> The conclusion in equation (14) is key to block skipping and indicates that, in order to minimize the MSE distortion, the M image blocks with smallest variance should have approximately zero bits, i.e., they should not be encoded.
>
> The last step is to find the M blocks that need to be skipped. At this time, it is only known that blocks to be skipped have lower block energy than those blocks that will eventually be encoded. An expression for the value of L in equation (13) is obtained in equation (15).

In other words, Ribas does not say that frame skipping and quantization parameters reduce distortion. Instead, Ribas says that frame skipping predicts the distortion quality of an entire frame before encoding, and block and frame skipping reduce the computational complexity at the encoder. Ribas says nothing about how quantization parameters can reduce distortion.

In any case, that is not what is claimed. The invention claims "determining, for each candidate object, a quantizer parameter and a skip parameter that *jointly minimizes an average total distortion* in the *video* while satisfying predetermined constraints, the average total distortion including spatial distortion of coded objects based on the quantizer parameter, and spatial and temporal distortion of uncoded objects based on the quantizer parameter and the skip parameter."

In other words, the claimed invention does not determine distortion on a block-by-block, or frame-by-frame basis. The invention minimizes an *average total distortion* in the *entire video*. Obviously, determining distortion *independently* and *individually*, on a frame-by-frame basis, as in Ribas can never minimize an average total distortion in a video. Furthermore, the determination as claimed is *joint*. The distortion calculations in Ribas are independent. In addition, the encoding as claimed is on video objects, not blocks or frames as described by Ribas.

The examiner's reasoning is a mere conclusion, and does not consider each and every element of what is claimed.

Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walker in view of Ribas and further in view of Ito et al. (U.S. Patent No. 6,377,309).

Ito describes a method for detecting MPEG-4 data inserted into an MPEG-2 data stream.

In claim 2, the object is a video object plane (VOP) having an arbitrary shape and size. The object is encoded with the quantizer parameter and the skip parameter that jointly minimizes an average total distortion in the video. Ito describes VOPs, which are well-known. Ito never describes determining a quantizer parameter and a skip parameter that jointly minimizes an average total distortion as claimed. Walker determines a quantization parameter based on complexity. The quantization parameter is ***disjoint*** from the skip parameter in Walker. Walker never describes minimizing ***total average distortion*** over an entire video. Accordingly, the applied combination of art fails to teach or suggest encoding a video object plane having an arbitrary shape and size with a quantization parameter and a skip parameter that jointly minimizes *an average total distortion in the video* as claimed.

In claim 3, the object is a video frame having a rectangular shape and fixed size. As stated above with respect to claim 1, Walker determines a quantization parameter based on a complexity measure. Complexity is not distortion. Walker never describes reducing total average distortion as claimed.

In claim 4, the skip parameter is f_s, and claimed is the skipping of $(f_s - 1)$ uncoded objects. Walker determines a skipped block based on a sum of absolute coefficient differences compared to a threshold. Walker fails to teach the skip parameter as claimed. Walker also fails to disclose skipping $(f_s - 1)$ uncoded objects. The claimed skip parameter f_s is based on a source frame rate divided by an average coded frame rate.

In claim 5, multiple candidate objects are encoded concurrently; each is encoded with a quantizer parameter and a skip parameter that jointly minimizes an average total distortion in the video. As stated above, neither Ito nor Walker describes encoding with a quantizer parameter and a skip parameter that jointly minimizes an average total distortion.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Walker in view Ribas and further in view of Sethuraman et al. (U.S. Patent No. 6,526,097).

Sethuraman describes controlling a frame rate by skipping frames based on a target *bit rate*. Sethuraman fails to cure the defects of Walker. Sethuraman never teaches a skip parameter and a quantizer parameter jointly minimizing an average total distortion in the video as claimed.

Sethuraman decides to skip frames based on a **target bit** rate only. Sethuraman does not disclose a skip parameter based on a **frame rate.** Those of ordinary skill in the art understand that a bit rate is the number of bits that are encoded per second. A frame rate is the number of frames per

second. Accordingly, the combination of Walker and Sethuraman fails to teach or suggest encoding a video object with a quantization parameter and a skip parameter that ***jointly*** minimizes an average total distortion in the video, where an average skip parameter is $\overline{f}_s = \frac{F_{src}}{\overline{F}}$, F_{src} is a source frame-rate, and $\overline{F}$ is an average coded frame rate as claimed.

The Examiner states that Sethuraman discloses a skip rate that is calculated by dividing a source frame rate by an average frame rate, see:

> Sethuraman further discloses that a skip parameter can be calculated by dividing the source frame rate by the average frame rate (Sethuraman: figure 7, column 7, lines 34-64, wherein the source frame rate is the frame rate and the average frame rate is the target frame rate). Therefore, it would have been obvious to

With all due respect, this is completely wrong. Figure 7 shows a flow diagram of a process performed by a function rcGetTarget of FIG. 6. An execution-constrained frame rate and a quality-constrained frame are generated. If the quality-constrained frame rate is greater than the execution-constrained frame rate, then the quality-constrained frame rate is limited to the execution-constrained frame rate. This step compares two frame rates, there is no ***division*** as claimed.

The target number of bits to encode the current frame is then generated based on the quality-constrained frame rate. Otherwise, the current frame is encoded as a P frame and the target number of bits is returned by the function rcGetTarget. After successfully generating a target number of bits to be used to encode the current P frame, the frame is encoded using any suitable compression algorithm.

The Applicants are puzzled why the examiner thinks this discloses an average skip parameter $\overline{f}_s = \frac{F_{src}}{\overline{F}}$, where F_{src} is a source frame-rate and $\overline{F}$ is an average coded frame rate. The rejection of claim 6 is improper.

All rejections have been complied with, and the applicant respectfully submits that the application is now in condition for allowance. The applicant urges the examiner to contact the applicant's agent at the phone and address indicated below if assistance is required to move the present application to allowance.

Please charge any shortages in fees in connection with this filing to Deposit Account 50-0749.

Respectfully submitted,
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